

299-W14-01 (A4913) Log Data Report

Borehole Information:

Borehole: 299-W14-01 (A4913)		Site: 216-T-28 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 225.65	GWL Date: 08/16/04		
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
136311.178 m	566953.318 m	01/54	672.19 ft	240	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.95	6 5/8	6	5/16	2.95	158
Welded Steel	0.0	8	unknown	unknown	0	240

Borehole Notes:

The logging engineer used a steel tape to measure the 6-in. casing. The 8-in. casing was visible at the ground surface but could not be measured. The presence of the 8-in. casing is described in Ledgerwood (1993). All logging measurements are referenced to top of the 6-in. casing. Before the borehole was logged a swab was acquired of the interior of the borehole. No contamination was detected on the swab.

Ledgerwood (1993) indicated the 6-in. casing was set inside the 8-in. casing on a packer to 158 ft. The 8-in. casing was perforated from 0 to 5 ft and from 20 to 150 ft and the annulus between the 6-in. and 8-in. casing was grouted. Apparently 15 gallons of sand were emplaced on top of the packer set at 158 ft. The 8-in. casing was also perforated from 195 to 230 ft. Ledgerwood indicated the groundwater level was at 210 and 200 ft in February 1954 and December 1992, respectively; the current level from TOC is approximately 226 ft.

Logging Equipment Information:

Logging System: Gamma 4E	Type: SGLS (70%) 34TP40587A
Calibration Date: 05/04	Calibration Reference: DOE-EM/GJ692-2004
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	3		
Date	08/16/04	08/17/04	08/17/04		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	224.0	60.0	29.0		
Finish Depth (ft)	30.0	30.0	3.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		

Log Run	1	2 Repeat	3		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A ³	N/A	N/A		
Pre-Verification	DE251CAB	DE261CAB	DE261CAB		
Start File	DE251000	DE261000	DE261031		
Finish File	DE251194	DE261030	DE261057		
Post-Verification	DE251CAA	DE261CAA	DE261CAA		
Depth Return Error (in.)	N/A	N/A	-1		
Comments	Fine-gain adjustment after files -165 and -191.	No fine-gain adjustment. High rate interval.	No fine-gain adjustment.		

Logging Operation Notes:

Logging was performed with a centralizer installed on the sonde except for log run 1. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 118. Maximum logging depth was 224 ft, approximately 1 ft above groundwater.

Analysis Notes:

Analyst:	Henwood	Date:	09/09/04	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations for SGLS spectra were calculated in EXCEL (source file: G4EJul04.xls). A combined casing thickness of 0.6345 in. (0.3125 in. + 0.322 in. for the 6- and 8-in. casings, respectively) was applied to the data from 0 to 158 ft. Below 158 ft a 0.322-in.-thick casing correction was applied. No dead time or water corrections were required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (⁴⁰K, ²³⁸U, and ²³²Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is included to facilitate correlation. The ²¹⁴Bi peak at 1764 keV was used to determine the naturally occurring ²³⁸U concentrations on the combination plot rather than the ²¹⁴Bi peak at 609 keV because it exhibited slightly higher net counts per second.

A comparison plot of the Westinghouse Hanford Company Radionuclide Logging System (RLS) data acquired in 1992 with the current SGLS data is included. Historical gross gamma logging plots have been copied from Fecht et al. (1977) and digitized. These logs are plotted with the current SGLS total gamma log.

Results and Interpretations:

^{137}Cs , ^{60}Co , and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected sporadically in the borehole from the ground surface to 218 ft. Near-surface contamination was measured between 3 and 6 ft with a maximum concentration of approximately 26 pCi/g at 4 ft. An interval from 149 to 160 ft with a maximum concentration of approximately 10 pCi/g is associated with a sand pack emplaced in the borehole in February 1983 (Ledgerwood 1993). Between 164 and 218 ft the ^{137}Cs is measured almost continuously at concentrations less than 1 pCi/g.

^{60}Co was detected between 30 and 60 ft. The maximum concentration was approximately 0.2 pCi/g at 39 ft.

^{154}Eu was detected between 73 and 83 ft at concentrations of approximately 0.6 pCi/g.

A comparison plot of RLS data acquired in 1992 with the current SGLS data is included. The RLS data were decayed to the date of the SGLS log data. Differences in calibration methodology or casing corrections appear to have resulted in a slight offset in calculated concentrations. However, the profiles of the sets of log data are similar, suggesting stability of contaminants since 1992.

Plots of historical gross gamma logs acquired in this borehole in 1963, 1968, and 1976 (before borehole remediation activities in 1983) are included (Fecht et al. 1977). Depth initiation problems or digitizing efforts appear to have resulted in depth discrepancies but are useful to discuss in a general sense. The earliest log data acquired in 04/29/63 indicate contamination existed in the vadose zone between approximately 25 and 50 ft. Between 1963 and 1968 elevated activity (relative to 1963) appears to exist all the way to the total depth of the borehole. It is possible the elevated activity is the result of a different, more sensitive, detection system being used in 1968. However, Fecht et al. (1977) state "Well W14-1 located 38 meters southeast of the crib shows lateral spreading of radioactive contaminants." WIDS reports: "Ritter (1966) states that a breakthrough of radioactive strontium and cesium to the groundwater beneath the crib occurred in 1965." (Note: Both of these quotes are referring to the 216-T-28 Crib.) By 1976, much of the contamination apparently consisted of short-lived radionuclides and significant decay had occurred. The 1976 profile suggests elevated activity between 30 and 50 ft and between 55 and 75 ft. The current SGLS data indicate ^{60}Co and ^{154}Eu in proximity to these respective depths. Otherwise, the 1976 data suggests background activity throughout the borehole and is similar to the current total gamma profile. One exception is the interval from 150 to 160 ft, where ^{137}Cs and slightly elevated total gamma are measured but the historical profiles suggest no elevated activity. This interval is associated with sandpack emplaced in 1983. It is not known why the sandpack would cause ^{137}Cs to concentrate.

The ^{40}K and ^{232}Th logs show some variations in concentrations, suggesting lithology changes that may be correlated with adjacent boreholes. Caution should be used when interpreting the data from the ground surface to 158 ft where grout is known to have been emplaced.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural and man-made radionuclides.

References:

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-West Resource Protection Wells*, WHC-SD-ER-TI-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

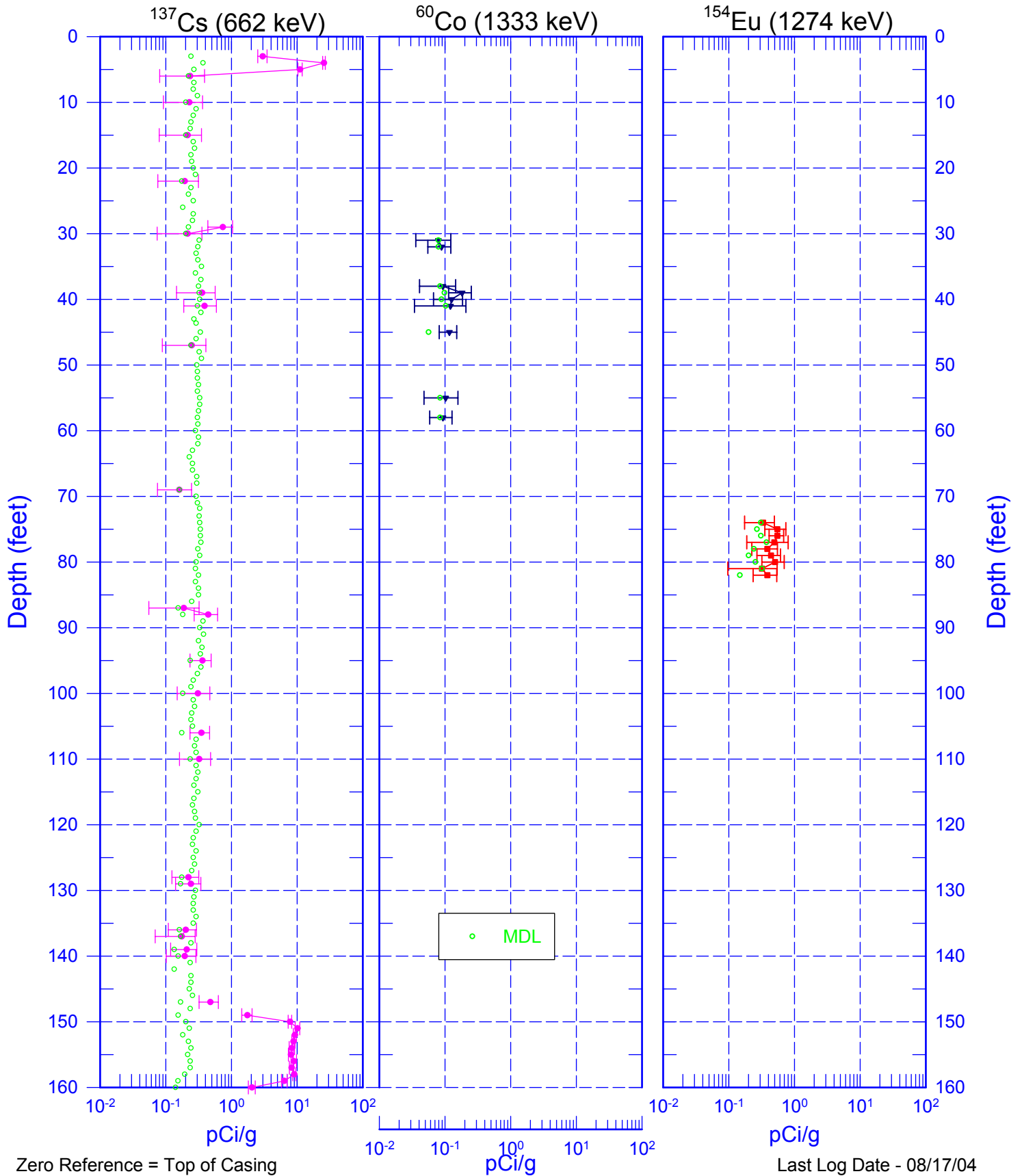
¹ GWL – groundwater level

² TOC – top of casing

³ N/A – not applicable

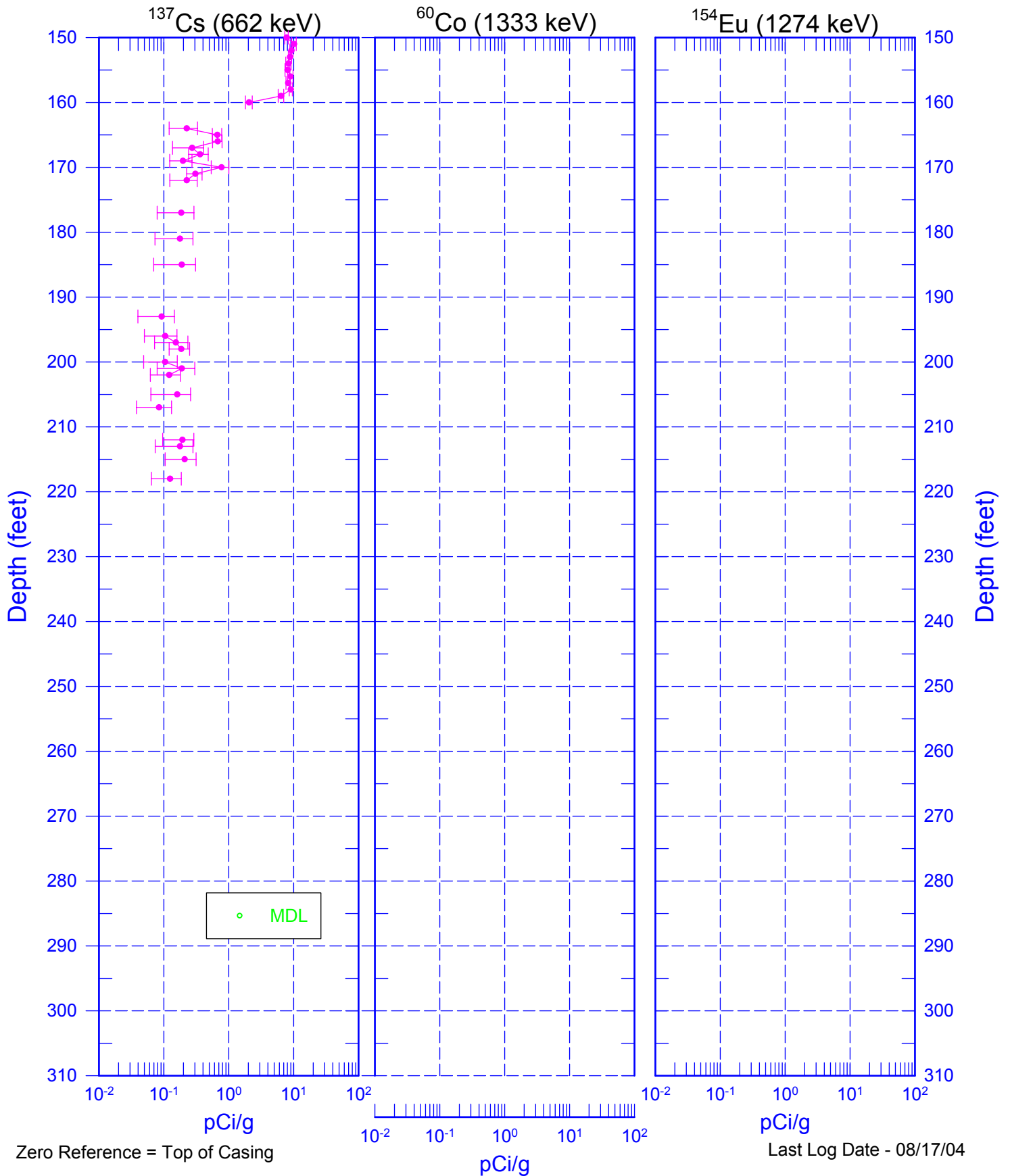
299-W14-01 (A4913)

Man-Made Radionuclides



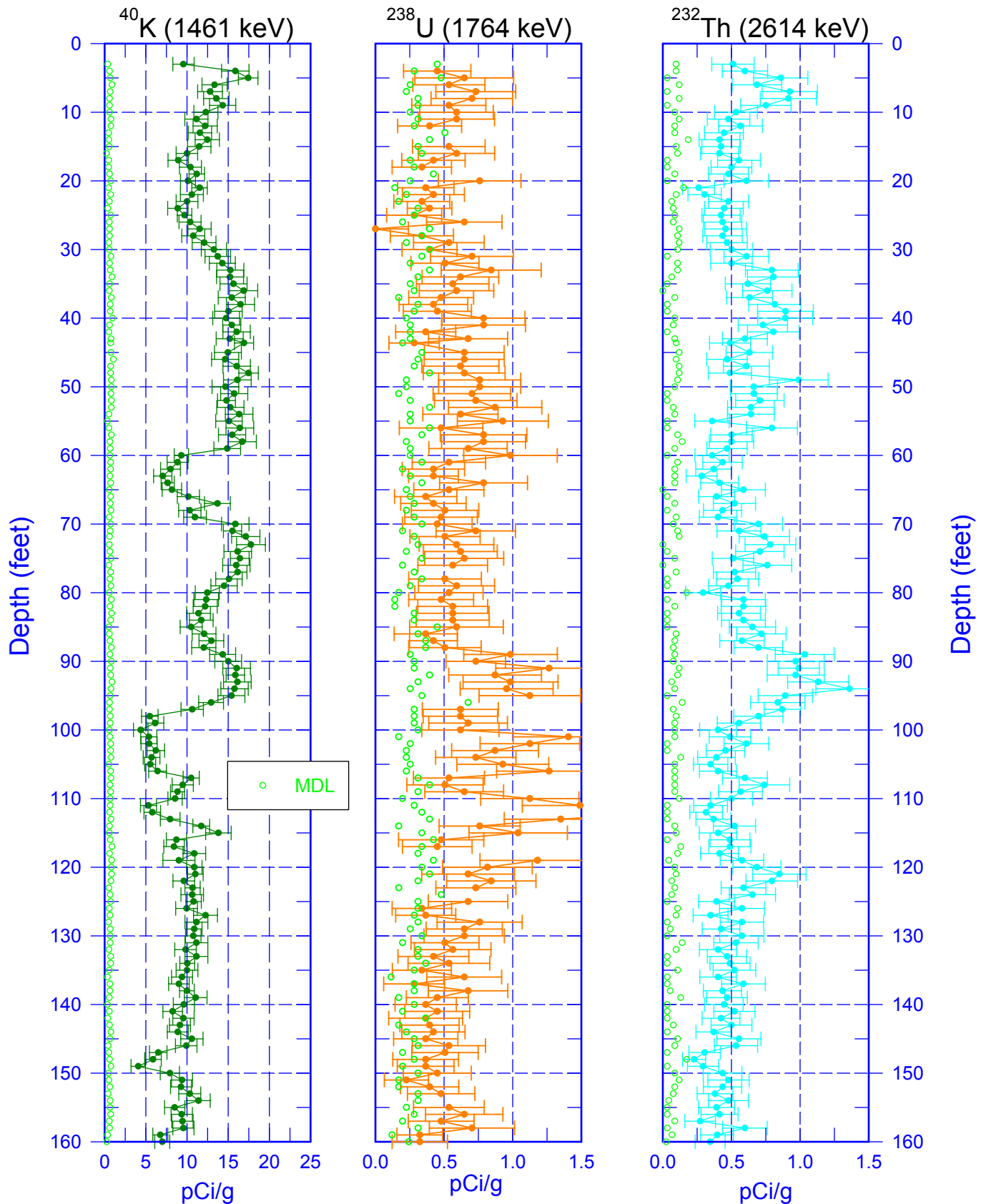
299-W14-01 (A4913)

Man-Made Radionuclides



299-W14-01 (A4913)

Natural Gamma Logs

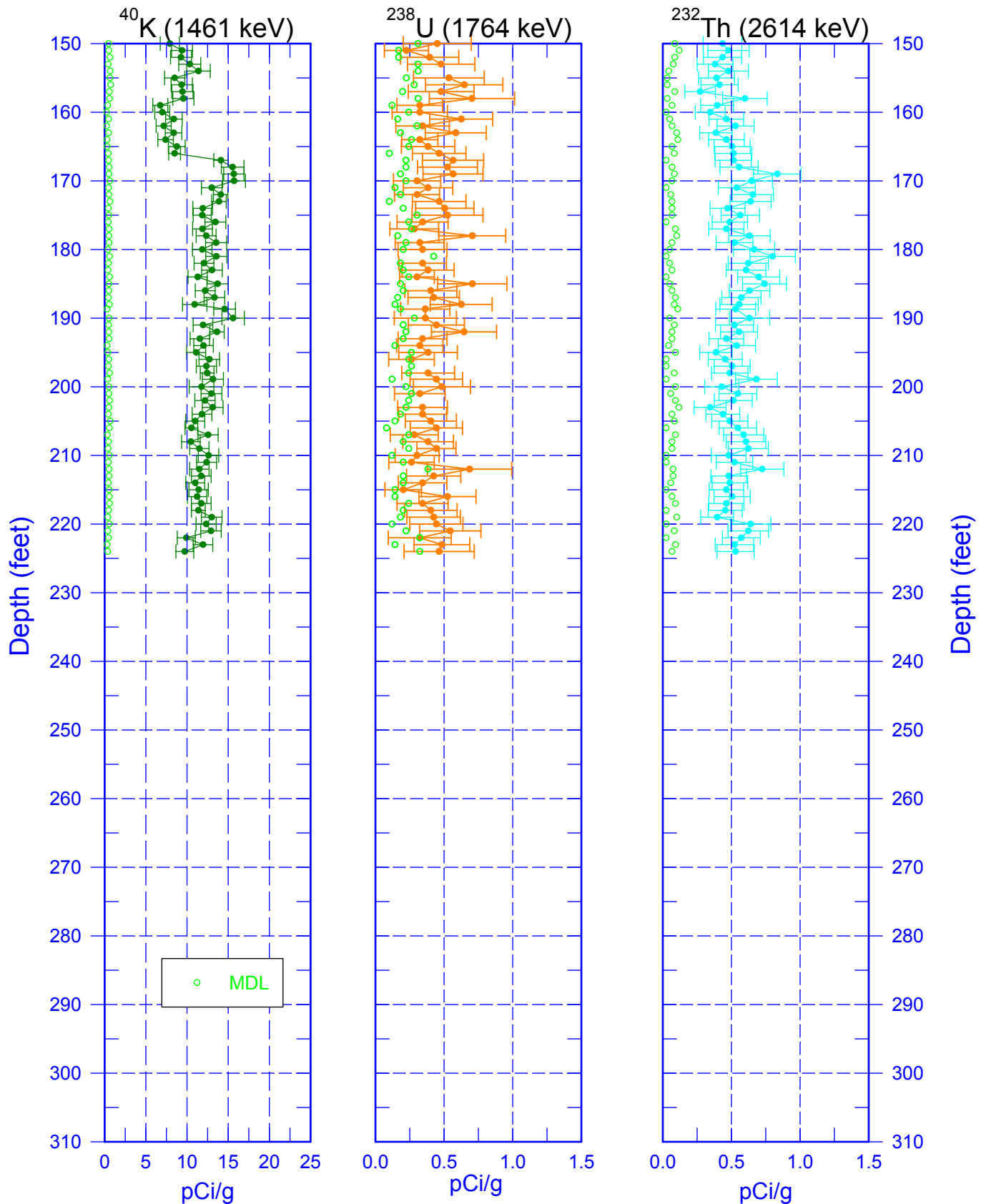


Zero Reference = Top of Casing

Last Log Date - 08/17/04

299-W14-01 (A4913)

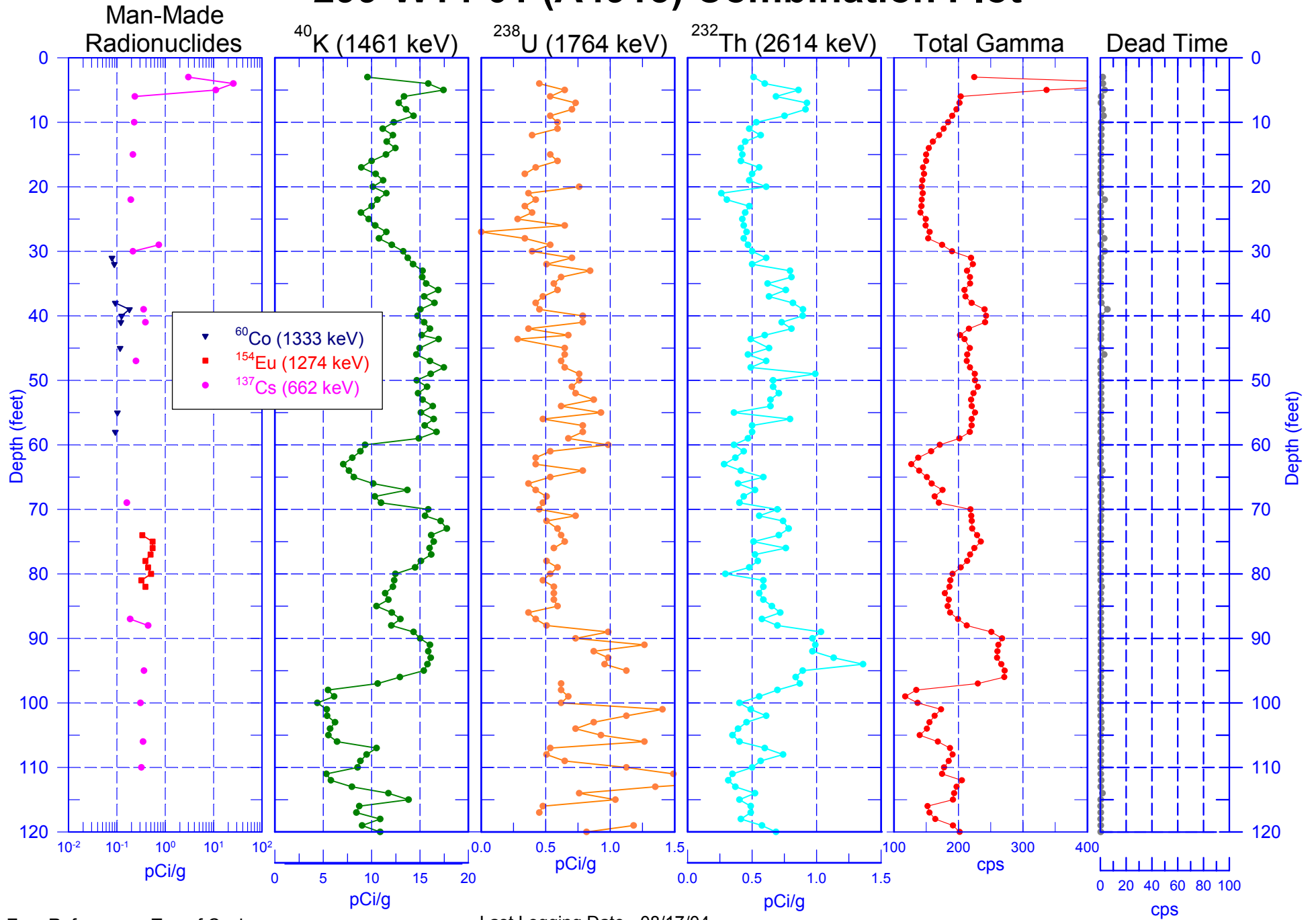
Natural Gamma Logs



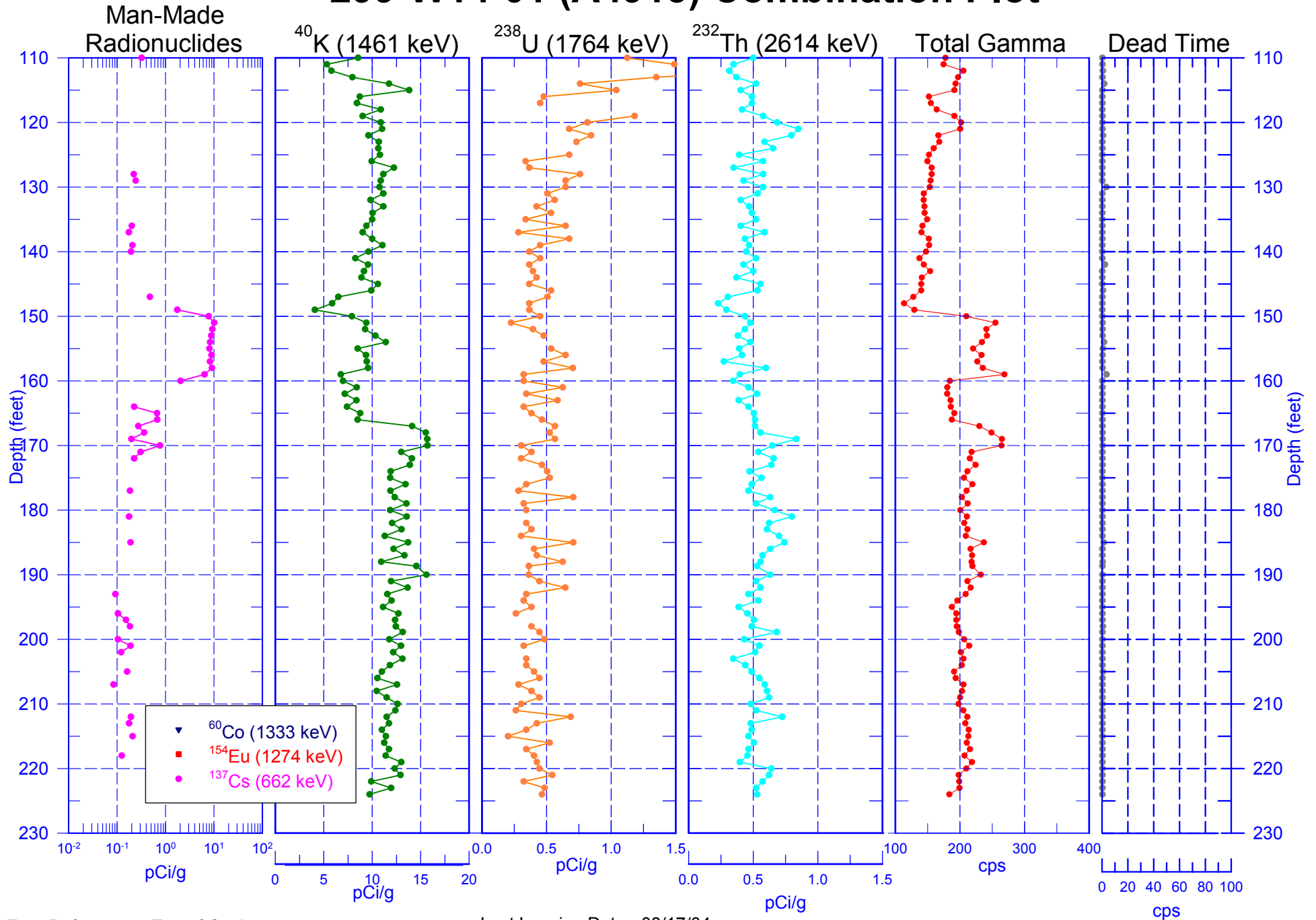
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Last Log Date - 08/17/04

299-W14-01 (A4913) Combination Plot

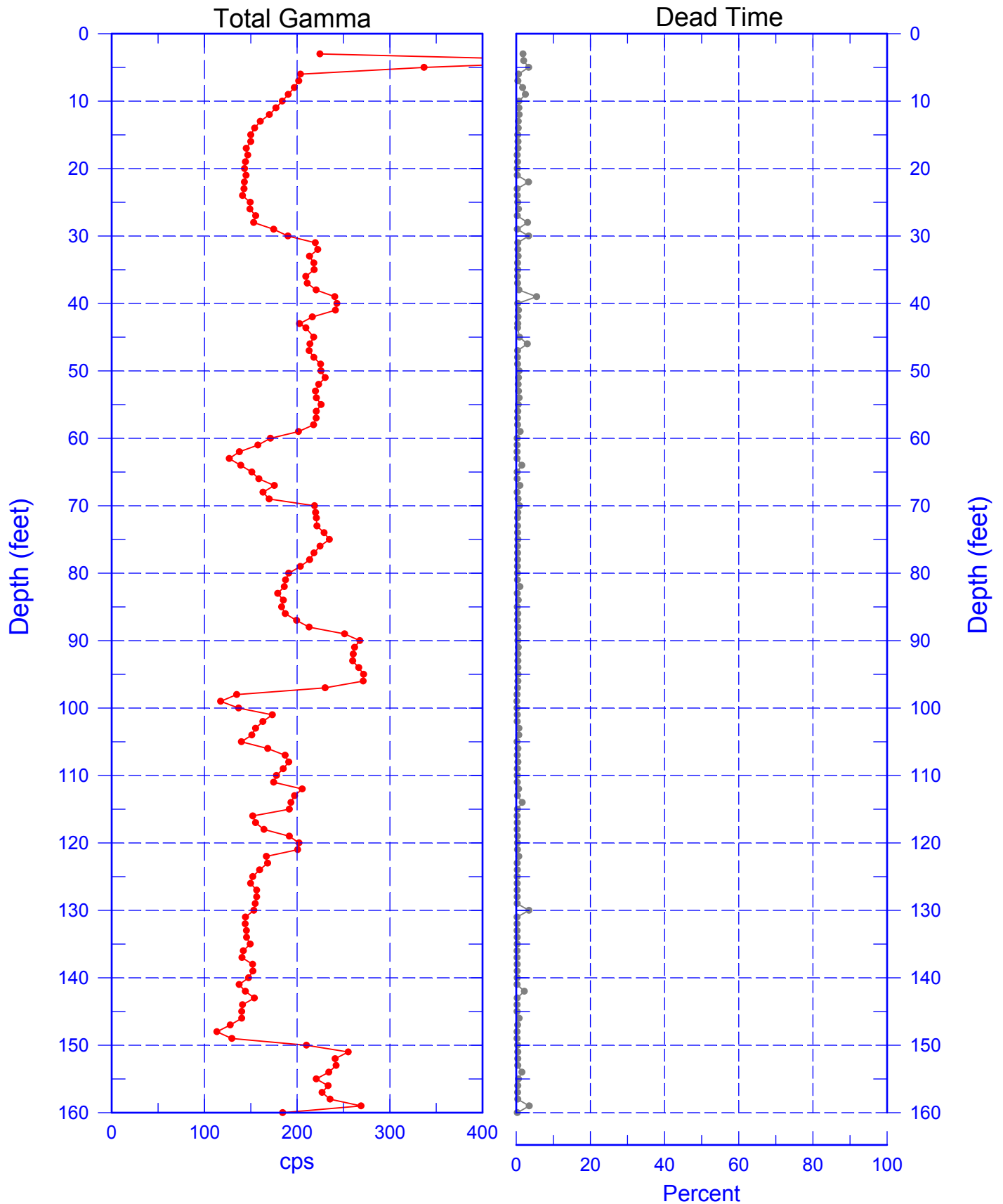


299-W14-01 (A4913) Combination Plot



299-W14-01 (A4913)

Total Gamma & Dead Time

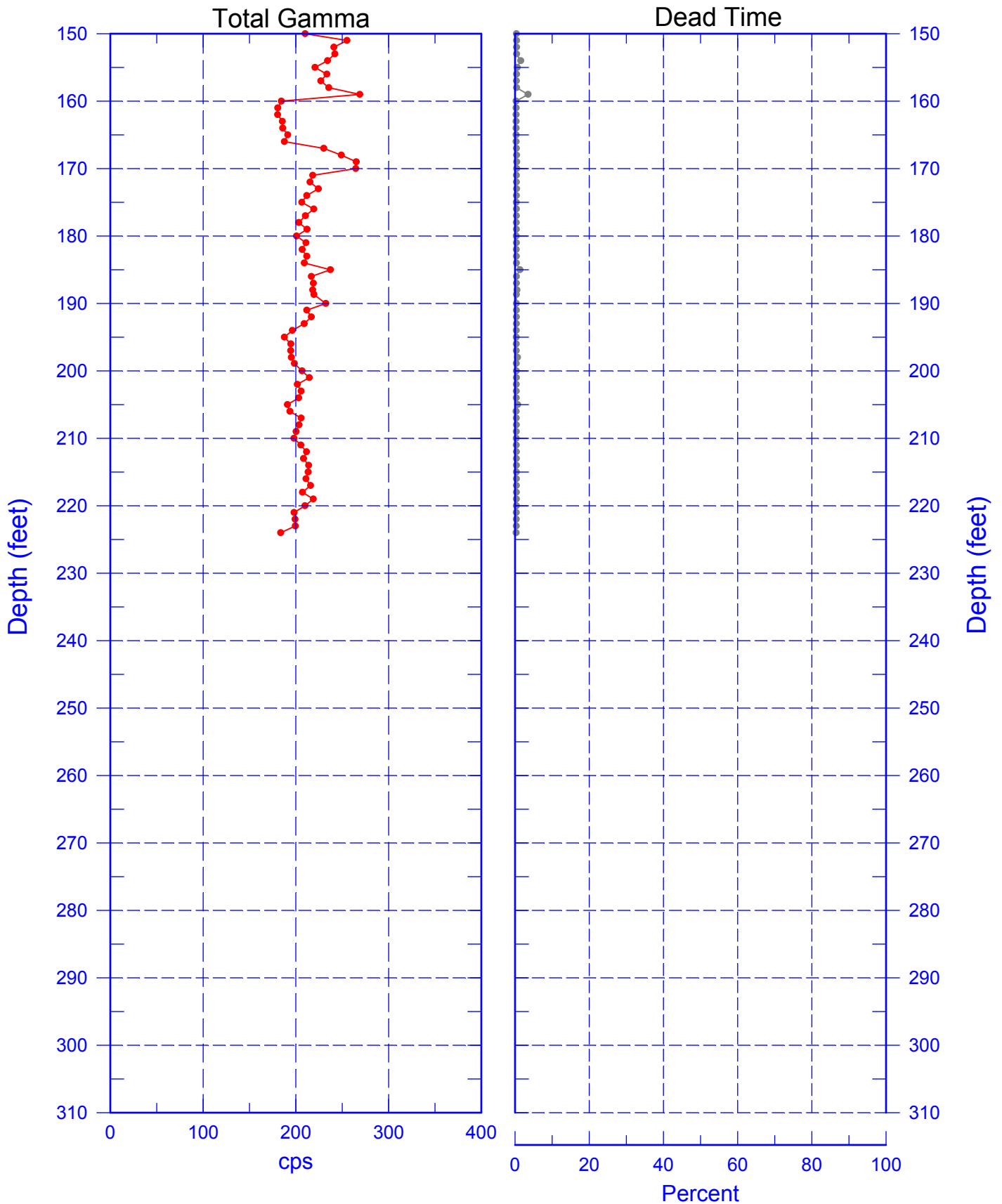


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Last Logging Date - 08/17/04

299-W14-01 (A4913)

Total Gamma & Dead Time

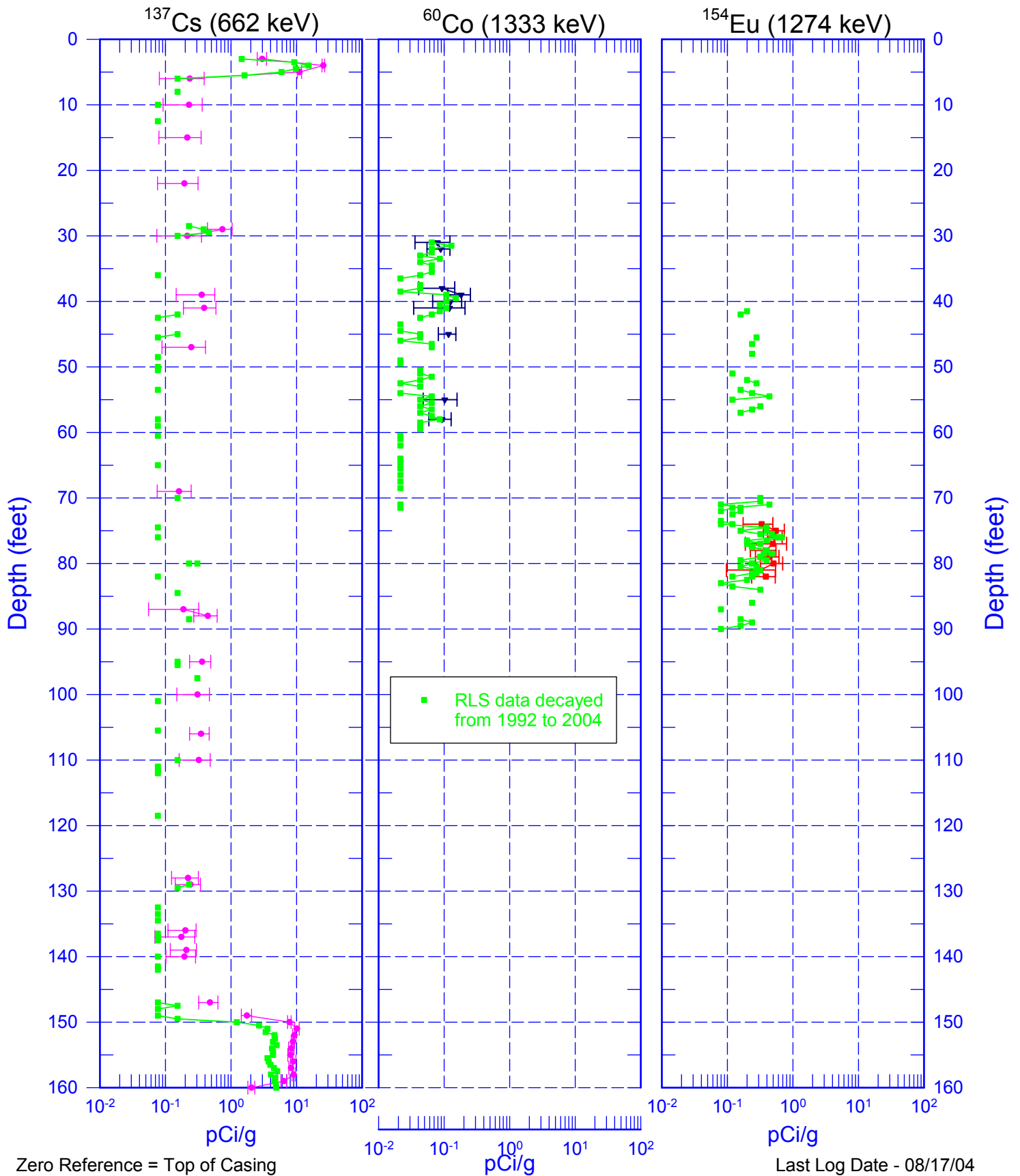


Zero Reference = Top of Casing

Last Logging Date - 08/17/04

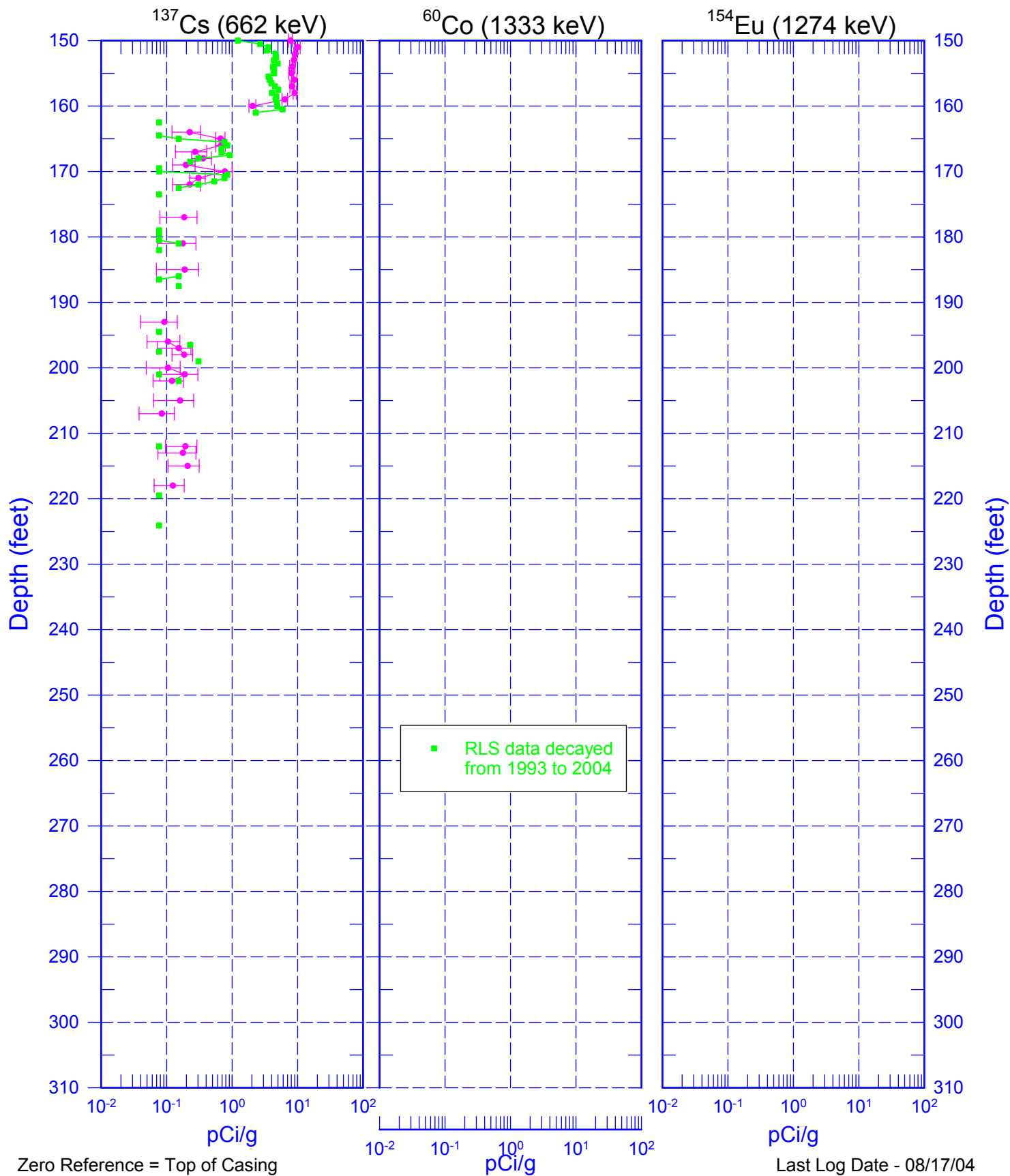
299-W14-01 (A4913)

Man-Made Radionuclide Comparison



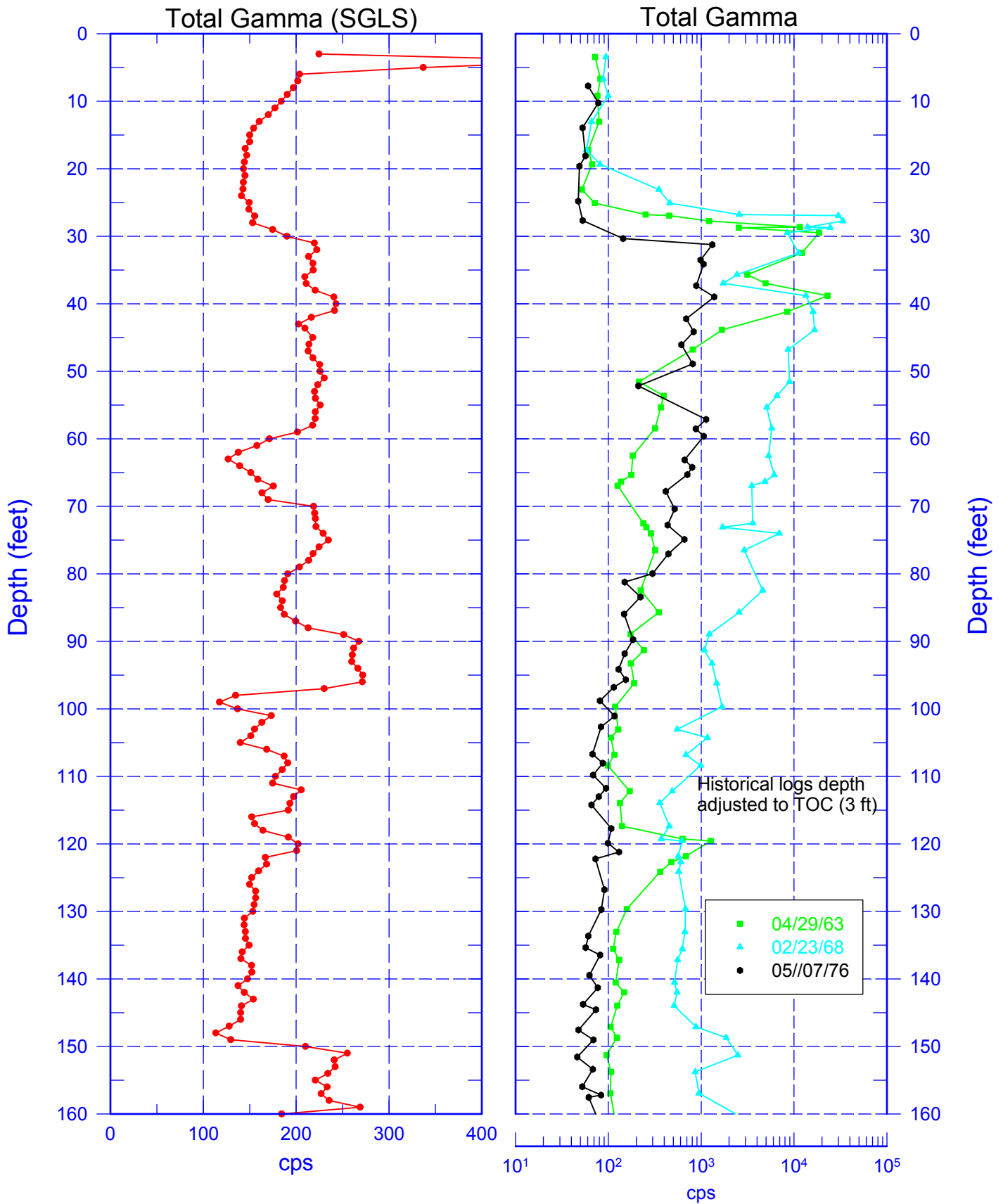
299-W14-01 (A4913)

Man-Made Radionuclide Comparison



299-W14-01 (A4913)

Total Gamma

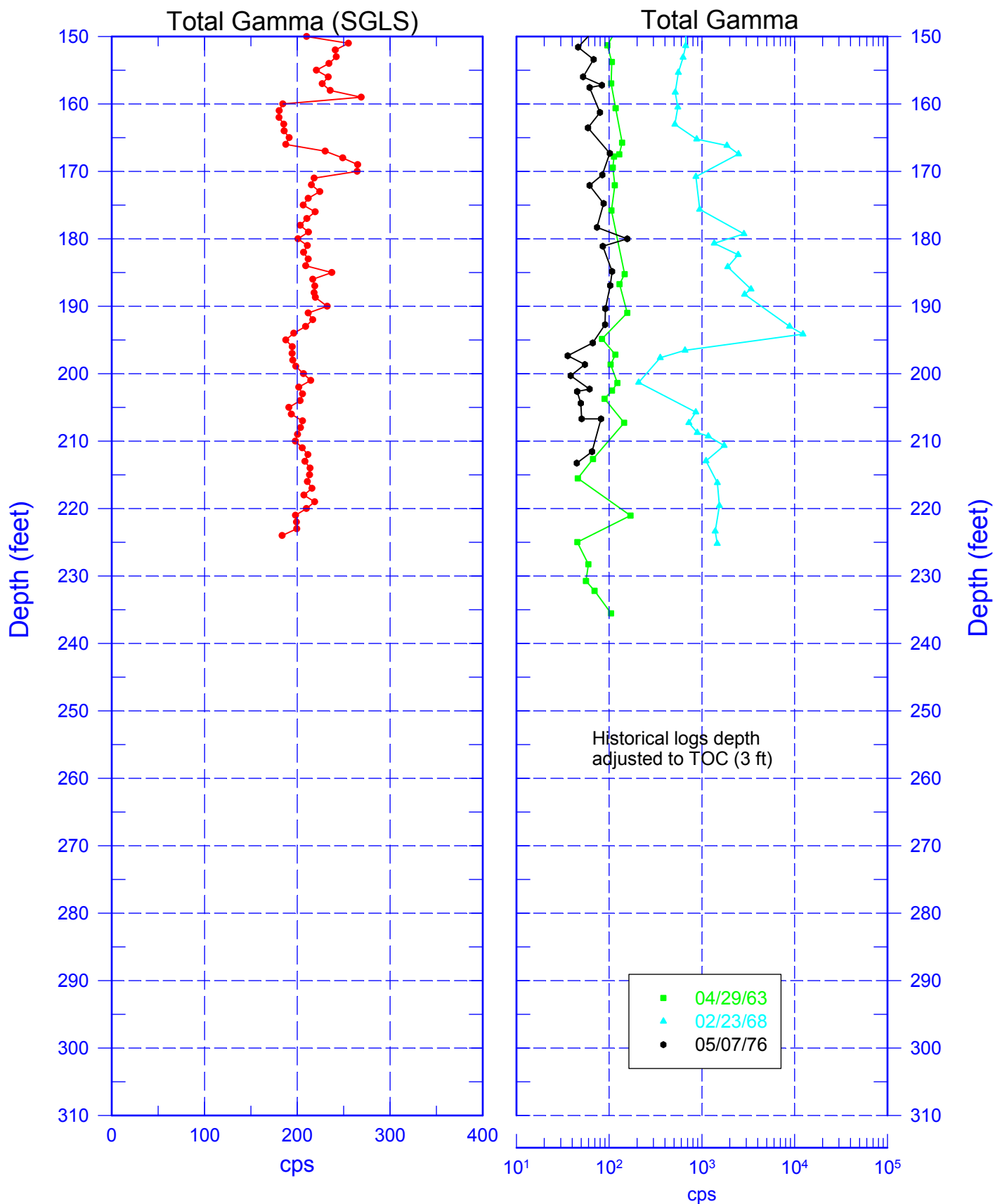


Zero Reference = Top of Casing

Last Logging Date - 08/17/04

299-W14-01 (A4913)

Total Gamma

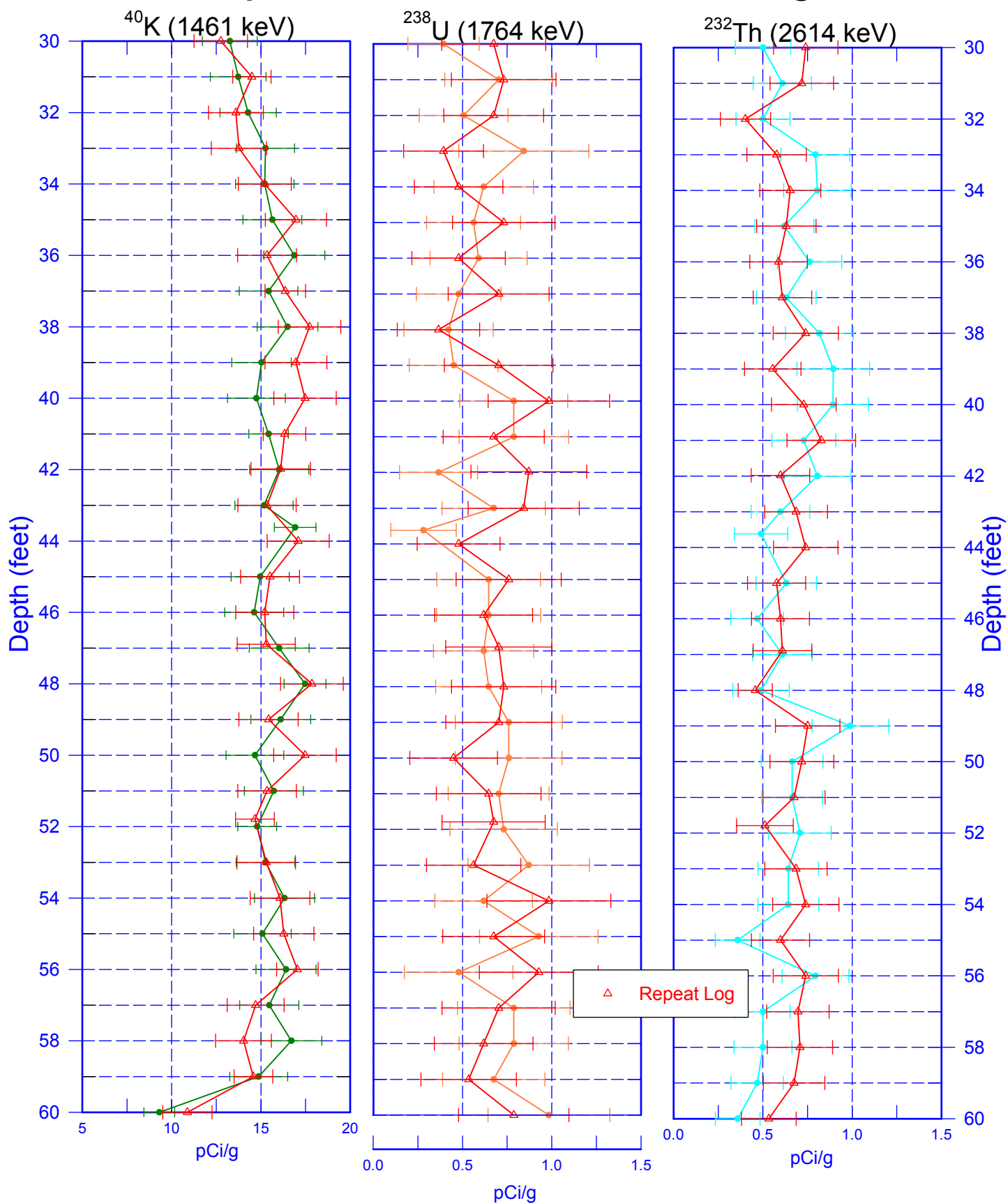


Zero Reference = Top of Casing

Last Logging Date - 08/17/04

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Repeat Section of Natural Gamma Logs

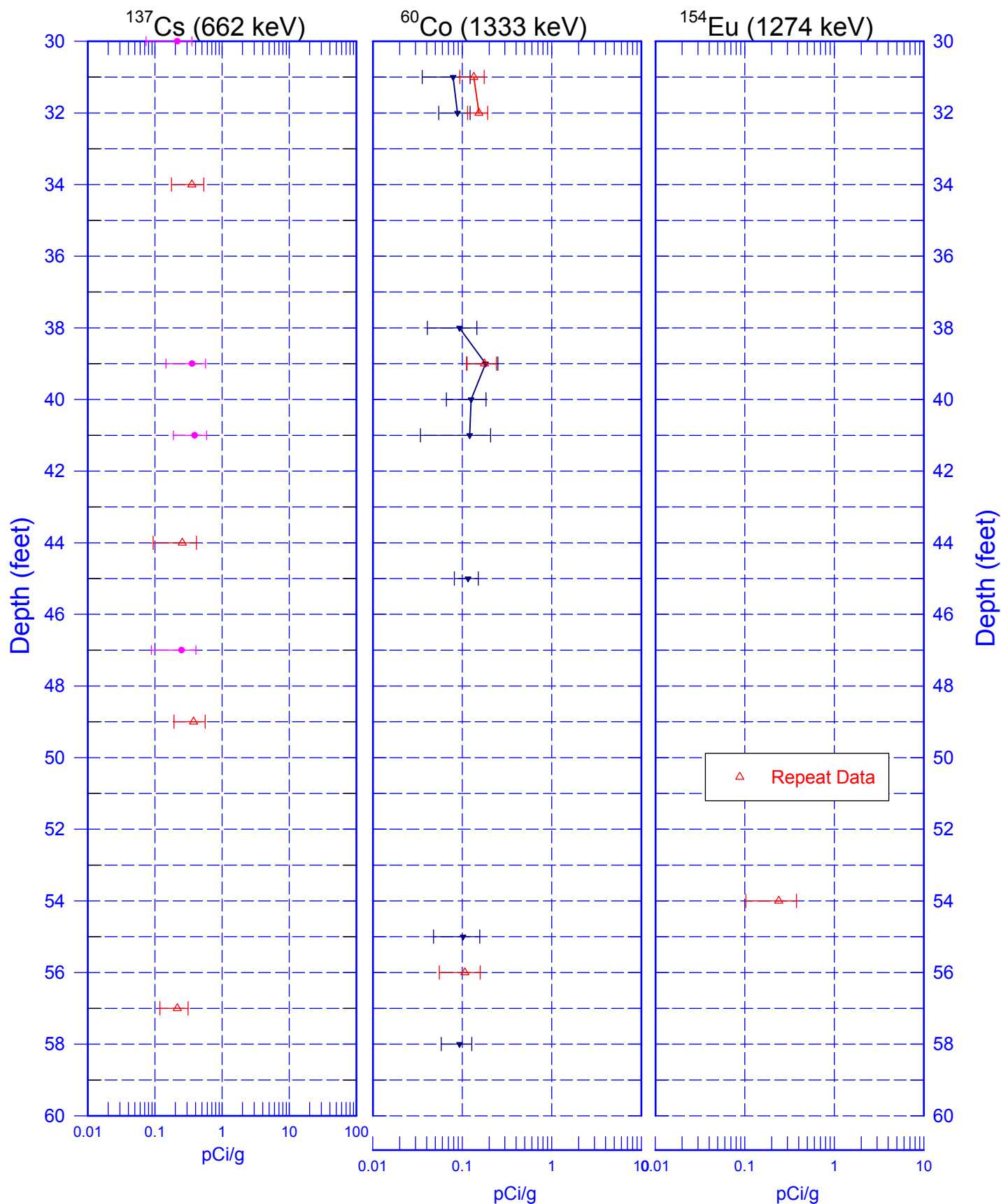


Zero Reference = Top of Casing

Last Log Date - 08/17/04

299-W14-01 (A4913)

Repeat Section of Man-Made Radionuclides



Zero Reference = Top of Casing

Last Log Date - 08/17/04